Co-Assembled Ultra Strong Hydrogel as a Potential Scaffold for Tissue Engineering

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Directing stem cell differentiation is a very important part in the field of tissue engineering. Since one way of directing it is by the mechanical strength of the scaffolds, fine tuning it is crucial. Strong scaffolds lead to the differentiation into bone cells which can then be used for bone regeneration. The purpose of our project is to design and produce a new scaffold, with high mechanical strength and durability and a high biocompatibility using the Co-assembly approach. Procedures: The hydrogels were prepared by the solvent switch technique, their mechanical, structural and biocompatible properties were characterized. The mechanical characterization was done using a rheometer, the structural characterization using HR-SEM and observation over time. The biocompatibility was examined by an XTT assay. Results: All the hydrogels showed a high viability making it possible to further investigate their use in biological applications. We found that the mechanical strength of the hybrid hydrogels was higher than the pure hydrogels` and higher than their linear sum. By this result, we provide the first evidence of synergistic improvement of mechanical properties in peptide hydrogels. The hydrogels presented in this work were the strongest peptide hydrogels described in the literature. In addition, the hybrid hydrogels showed an extended period of stability compared to the few days and six months of the pure hydrogels. Conclusions: We propose to use this hydrogel in the tissue engineering field for the differentiation of stem cells into bone cells while taking advantage of the strong mechanical properties of the hybrids and durability. We provide a proof of concept that Co-assembly can be implied to control and enhance mechanical properties.